GAS CONTROL VALVE ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of th Invention

The present invention relates to a gas control valve assembly and, more particularly, to such a gas control valve assembly that can be controlled to turn on/off the supply of fuel gas, can also be controlled to regulate the flow rate of supplied fuel gas.

2. Description of the Related Art

A valve is a device which controls the flow of a liquid or gas through a pipe by opening and closing the passage. In a hot water heater or furnace, a gas valve may be used to control the supply of fuel gas by means of pressure difference. A gas valve of this kind comprises a valve flap and two pressure chambers at two sides of the valve flap. When the pressure of the two pressure chambers is in balance, a small flow rate of fuel gas passes out of the first pressure chamber to the gas nozzle for ignition by sparked discharged from a discharging electrode to produce an ignition flame. When the induction electrode detected the presence of the ignition flame, the gas inlet of the first pressure chamber is closed to lower the pressure of the first pressure chamber, causing the valve flap to change the position for enabling a big flow rate of fuel gas to pass out of the gas valve to the gas burner for burning by the ignition flame to produce a master flame for heating. This design of gas valve cannot regulate the flow rate of fuel gas passing to the gas burner. For controlling the flow rate of fuel gas, an external gas flow rate regulator shall be used.

SUMMARY OF THE INVENTION

The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide a gas control valve assembly, which can be controlled to turn on/off the supply of fuel gas, can also be controlled to regulate the flow rate of supplied fuel gas.

To achieve this and other objects of the present invention, the gas control valve assembly comprises a valve seat, the valve seat having a gas inlet, first and second gas outlets, a gas passageway in communication between the gas inlet and the gas outlets, and three mounting holes in communication with the gas passageway, a first electromagnetic valve mounted in the first mounting hole and adapted to control the flowing of fuel gas from the gas passageway to the second mounting hole and the first gas outlet, a second electromagnetic valve mounted in the second mounting hole and adapted to control the flowing of fuel gas from the gas passageway to the second gas outlet, and a third electromagnetic valve mounted in the third mounting hole and adapted to control the flowing of fuel gas to the second gas outlet independently or with the second electromagnetic valve.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a gas control valve assembly according to the present invention.

FIG. 2 is an exploded view of the gas control valve assembly according to the present invention.

FIG. 3 is a top view of the valve seat for the gas control valve

assembly according to the present invention.

FIG. 4 is a sectional view taken along line A-A of FIG. 3.

FIG. 5 is a sectional view taken along line B-B of FIG. 3.

FIG. 6 is a sectional view taken along line C-C of FIG. 3.

FIG. 7 is similar to FIG. 3 but showing the first electromagnetic valve activated and fuel gas passed out of the output port of the first electromagnetic valve (see the arrowhead).

FIG. 8 is similar to FIG. 7 but showing the first electromagnetic valve and the second electromagnetic valve activated and fuel gas passed out of the output port of the second electromagnetic valve.

FIG. 9 is a sectional view substantially same as FIG. 6.

FIG. 10 is similar to FIG. 9 but showing different designs of screws respectively installed in the electromagnetic valves.

FIG. 11 is an elevational view of an alternate form of the gas control valve assembly according to the present invention.

FIG. 12 is an elevational view of another alternate form of the gas control valve assembly according to the present invention.

FIG. 13 shows an infrared receiver and an electronic igniter respectively mounted in the front and back sides of the valve seat of the gas control valve assembly according to the present invention.

FIG. 14 is similar to FIG. 13 but showing different designs of the infrared receiver and the electronic igniter.

FIG. 15 shows an infrared receiver and an electronic igniter mounted in the front side of the valve seat of the gas control valve assembly according to the present invention.

FIG. 16 shows an electronic igniter mounted in the back side of the valve seat of the gas control valve assembly according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1~3, a gas control valve assembly **10** is shown comprising a valve seat **1** defining therein a gas passageway **11**. The gas passageway **11** has a gas inlet **12** connected to a fuel gas source, a first gas outlet **13** connected to a gas nozzle (not shown), and a second gas outlet **14** connected to a gas burner (not shown). The valve seat **1** further comprises a first mounting hole **15**, a second mounting hole **16**, and a third mounting hole **17** (see FIG. 6). The mounting holes **15~17** are disposed between the first gas inlet **12** and the gas outlets **13** and **14**, forming a part of the gas passageway **11**. A first electromagnetic valve **3** is fastened to the first mounting hole **15** with screws **30**, and adapted to control the flowing of fuel gas from the gas passageway **11** to the second mounting hole **16**, the third mounting hole **17** and the first gas outlet **13**. A second electromagnetic valve **5** is fastened to the second mounting hole **16** with screws **50**, and adapted to control the flowing of fuel gas from the gas passageway **11** to the second gas outlet **14**. The third mounting hole **17** is provided at the back side (the bottom side in FIGS. 1 and 2) in vertical alignment with the second mounting hole **16**. A third electromagnetic valve **7** is fastened to the third mounting hole **17** with screws (not shown), and adapted to control the flowing of fuel gas from the gas passageway **11** to the second gas outlet **14**. The electromagnetic valves **3, 5,** and **7** are normal-close valves, i.e.,

the valve stems **31, 51**, and **71** are regularly maintained in the close position. O-rings **20~22** are respectively mounted in the mounting holes **15~17** to seal the gap between the respective mounting holes and the respective electromagnetic valves. Because the electromagnetic valves of the known art, no further detailed description in this regard is necessary.

When the gas range is in OFF position, fuel gas flows from the gas inlet **12** through the gas passageway **11** to the first mounting hole **15**.

Referring to FIG. 7, when switched the gas range to ON position, the valve stem **31** of the first electromagnetic valve **3** is moved to the open position, enabling fuel gas to flow from the first mounting hole **15** through the output port **33** of the first electromagnetic valve **3** into the gas passageway **11** and then to flow from the gas passageway **11** through the second mounting hole **16** and the third mounting hole **17** to the first gas outlet **13** and then the gas nozzle for ignition by sparks discharged from the discharging electrode of the electronic igniter (not shown) to produce an ignition flame.

Referring to FIG. 8, upon the presence of an ignition flame, the flame induction electrode (not shown) is induced to stops the electronic igniter from discharging high voltage, and simultaneously to connect electricity to the second electromagnetic valve **5** and/or the third electromagnetic valve **7**, causing the second electromagnetic valve **5** and/or the third electromagnetic valve **7** to move the valve stem **51** and/or valve stem**71** to the open position, for enabling fuel gas to pass

from the second mounting hole **16** (or third mounting hole **17**) through the output port **53** of the second electromagnetic valve **5** and/or the output port **73** of the third electromagnetic valve **7** into the gas passageway **11** and then to flow from the gas passageway **11** to the second gas outlet **14** and then the gas burner for burning by the aforesaid ignition flame to produce a master flame for heating.

The operator may operate the remote controller (not shown) to select the low-flame mode. At this time, only the third electromagnetic valve **7** is opened, and a low flow rate of fuel gas passes out of the second gas outlet **14** to the gas burner for burning. When the user changed the setting from the low-flame mode to the medium-flame mode, only the second electromagnetic valve **5** is opened. At this time, a medium flow rate of fuel gas passes out of the second gas outlet **14** to the gas burner for burning. When the user changed the setting to the high-flame mode, the second electromagnetic valve **5** and the third electromagnetic valve **7** are simultaneously opened, and a high flow rate of fuel gas passes out of the second gas outlet **14** to the gas burner for burning. Therefore, the gas control valve assembly **10** can conveniently be controlled to regulate the flow rate of fuel gas and to further control the intensity of the flame.

When turned off power supply, all the electromagnetic valves are off and returned to the respective close position to stop fuel gas from passing through the gas passageway **11**.

Referring to FIGS. 2 and 4, a screw hole **23** is formed in the valve seat **1** between the second mounting hole **16** (or third mounting

hole **17**) and the second gas outlet **14** and connected to the gas passageway **11** through a tapered gas hole **19**, and a detection screw **24** is threaded into the screw hole **23**. The detection screw **24** comprises a threaded shank **25** threaded into the screw hole **23**, a conical tip **26** axially extended from one end of the threaded shank **25** and adapted to control the passage of the tapered gas hole **19**, and two cut planes **27** at two sides of the threaded shank **25**. When rotating the screw **24** counter-clockwise, the conical tip **26** is moved away from the tapered gas hole **19**, for enabling fuel gas to pass through the gaps **28** between the periphery of the screw hole **23** and the cut planes **27** to a flow indicator or pressure gage that measures the flow rate or gas pressure in the gas passageway **11**. Similar detection screws (not shown) are respectively installed in the gas passageway **11** between the gas inlet **12** and the first mounting hole **15** and between the first mounting hole **15** and the second (or third) mounting hole **16** (or **17**) to detect gas flow rate or pressure in different segments of the gas passageway **11**. Further, a retainer **18** is fastened to the outer end of the screw hole **23** to stop the detection screw **24** from falling out of the screw hole **23**. Alternatively, the outer end of the screw hole **24** may be made smaller than the outer diameter of the detection screw **24** to stop the detection screw **24** from falling out of the screw hole **23**.

For easy fabrication, the aforesaid three electromagnetic valves have the same structure. However, for the passing of different gas flow rates, a first barrel **34** is installed in the output port **33** of the first electromagnetic valve **3** (see FIG. 5). The first barrel **34** has one end

mounted with an O-ring **35** and the other end inserted into the valve seat **1** to connect the first electromagnetic valve **3** to the gas passageway **11**. A second barrel **54** is installed in the output port **53** of the second electromagnetic valve **5** (see FIG. 6). The inner diameter of the second barrel **54** is relatively smaller than the first barrel **34**.The second barrel **54** has one end mounted with an O-ring **55** and the other end inserted into the valve seat **1** to connect the second electromagnetic valve **5** to the gas passageway **11**. A third barrel **74** is installed in the output port **73** of the third electromagnetic valve **7** (see FIG. 6). The inner diameter of the third barrel **74** is relatively smaller than the second barrel **54**.The third barrel **74** has one end mounted with an O-ring **75** and the other end inserted into the valve seat **1** to connect the third electromagnetic valve **7** to the gas passageway **11**. By means of the use of different barrels **34, 54,** and **74**, the gas flow rate is relatively controlled. Alternatively, the barrels **54** and **74** can be made having an inner diameter equal to the barrel **34** (see FIG. 9).

Actually, many methods can be employed to achieve change of gas flow rate. For example, as shown in FIG. 10, a screw **56** is fastened to the opening of the through hole **52** in the second electromagnetic valve **5**. The screw **56** has a plain extension **57** of diameter smaller than the through hole **52**. Therefore, fuel gas is allowed to pass out of the output port **53** of the second electromagnetic valve **5** through the gap **58** in the through hole **52** around the periphery of the plain extension **57**. By means of the plain extension **57** of the screw **56**, the gas flow rate is changed, i.e., the gas flow rate is indirectly proportional to the outer

diameter of the plain extension **57**. The screw **76** sealing the opening of the through hole **72** of the third electromagnetic valve **7** can be made having the same design.

Actually, in FIG. 10, the screw **76** is made having an extension **77** and an L-shaped through hole **78** through the extension **77**. The outer diameter of the extension **77** is equal to the inner diameter of the through hole **72**. The radially extended side of the L-shaped through hole **78** is aimed at the output port **73** of the third electromagnetic valve **7** for enabling fuel gas to pass out of the output port **73** of the third electromagnetic valve **7** through the L-shaped through hole **78** of the screw **76**. Further, a groove **79** is provided around the periphery of the extension **77** and disposed in air communication with the output port **73** of the third electromagnetic valve **7**. The screw **56** sealing the opening of the through hole **52** of the second electromagnetic valve **5** may be made in this way. Because the gas flow rate passing through the first electromagnetic valve **3** is greater than the second electromagnetic valve **5** and the third electromagnetic valve **7**, the screw **36** remains unchanged.

Referring to FIGS. 5 and 6, the valve stems **31, 51,** and **71** of the electromagnetic valves **3, 5,** and **7** are respectively mounted with a washer **39, 59,** or **70** that supports the respective valve stem against deformation and enables the respective valve stem to positively seal the corresponding input port of the through hole **32, 52,** or **72**.

In another embodiment of the present invention as shown in FIG. 11, the aforesaid third electromagnetic valve **7** is eliminated, and the

first and second electromagnetic valves **3** and **5** are used to control gas flow rate. Because only the second electromagnetic valve **5** controls the passage to the second gas outlet **14**, the gas flow rate through the gas outlet **14** is constant. A flow rate control valve may be used to regulate the flow rate of fuel gas passing into or out of the gas passageway **11**.

According to the alternate form shown in FIG. 12, the valve seat **1** of the gas control valve assembly **10** comprises a fourth mounting hole (not shown) aimed at the first mounting hole **15**, and a fourth electromagnetic valve **9** mounted in the fourth mounting hole and synchronously operated with the first electromagnetic valve **3** for enabling more amount of fuel gas to pass to the gas passageway **11**, i.e., four electromagnetic valves **3, 5, 7,** and **9** are used to control and regulate the flow rate of fuel gas.

Referring to FIG. 13, the electronic igniter, referenced by **80**, is installed in the back side (the bottom side) of the valve seat **1** of the gas control valve assembly **10**, and adapted to control the ignition and induction of the gas range and the close/open of the aforesaid electromagnetic valves. The infrared receiver **85** is provided at the top side of the valve seat **1** of the gas control valve assembly **10**. The infrared receiver **85** comprises a gas range on/off button **82**, a flame control **84** for high fire, medium fire, low fire, and fire off controls in proper order. The infrared receiver **85** and the electronic igniter **80** may be respectively bilaterally extended downwards or upwards to block the lateral sides of the valve seat **1** as shown in FIG. 14, leaving the gas inlet **12** and the gas outlets **13** and **14** exposed to the outside for

installation. Further, the infrared receiver **85** has a plurality of tool holes **81** respectively aimed at the detection screws **24** of the gas control valve assembly **10** and respectively sealed with a respective detachable plug **83**. Through the tool holes **81**, a screwdriver can be inserted to adjust the detection screws **24**.

Referring to FIG. 15, a control box **86** may be used and fastened to the valve seat **1** to hold the aforesaid electronic igniter and infrared receiver on the inside.

Referring to FIG. 16, the aforesaid infrared receiver may be eliminated, and the electronic igniter **80** may be installed in the back side of the valve seat **1**. In this case, the gas range on/off button and flame fire control button must be installed in the electronic igniter **80**.

A prototype of gas control valve assembly has been constructed with the features of FIGS. 1~16. The gas control valve assembly functions smoothly to provide all of the features discussed earlier.

Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.